

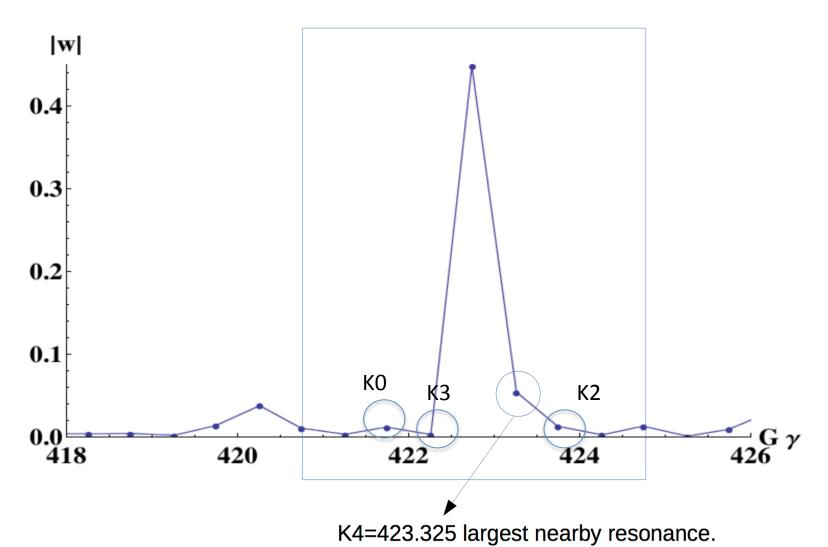
Preparation for FY17 pp run

- Requirements for Run:
 - Energy 255 GeV
 - E-lens phase advance between IP's 8 and 10.
 - Luminosity leveling
 - Transverse Polarization
- Differences from FY13 run:
 - No PHENIX
 - No orbit offset through STAR
 - No Rotators (no rotator ramp)

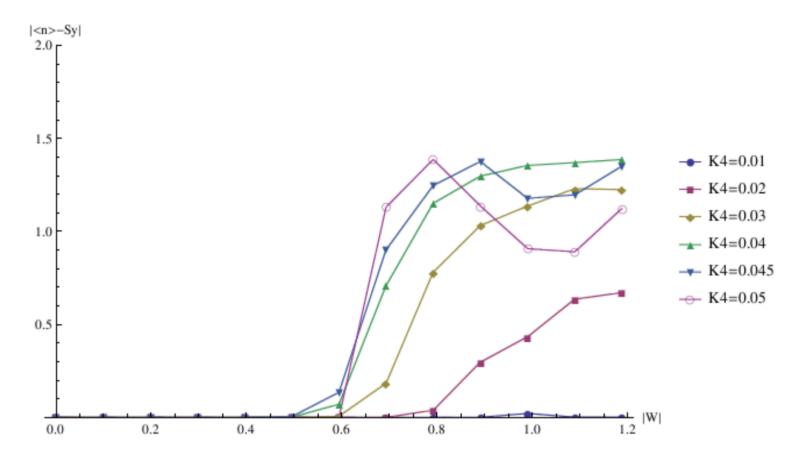
E-lens phase advance vs. Polarization

- On Ramp losses at the three strongest resonances yield a total of ~ 10-20% loss depending on emittance:
 - Larger nearby resonances made these losses worse for the old e-lens lattice.
 - Theoretical work suggests these losses can be mostly eliminated by reducing these smaller resonance <
 0.01 magnitude at 10Pl mm-mrad
- Simulations of store Polarization lifetime show that it can suffer due to higher low level resonances.

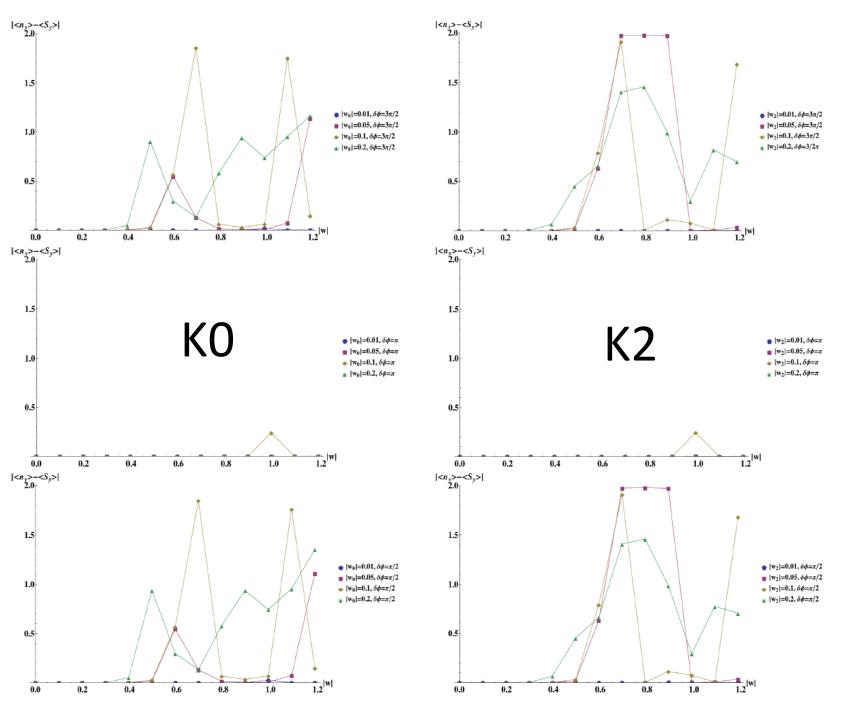
Analysis of FY12 lattice Crossing 393+NU resonance



K4 seems singular in determining polarization aperture.



Lattice independent tracking with 5 resonance from FY12 varying K4=423.325 strength



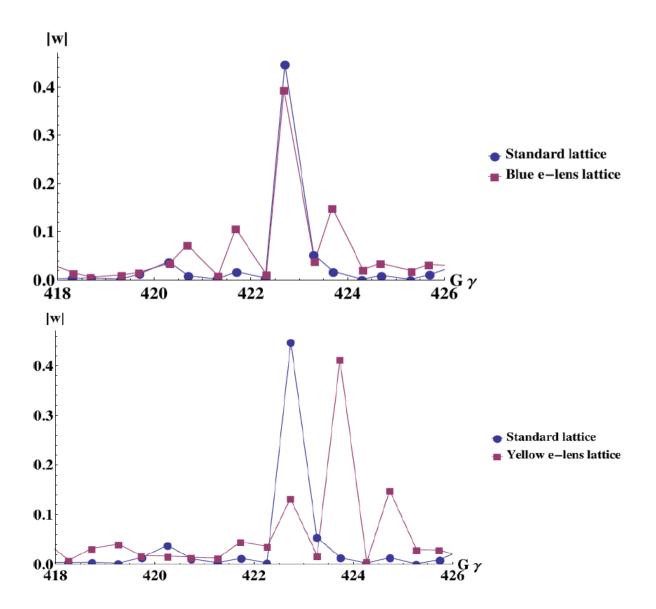


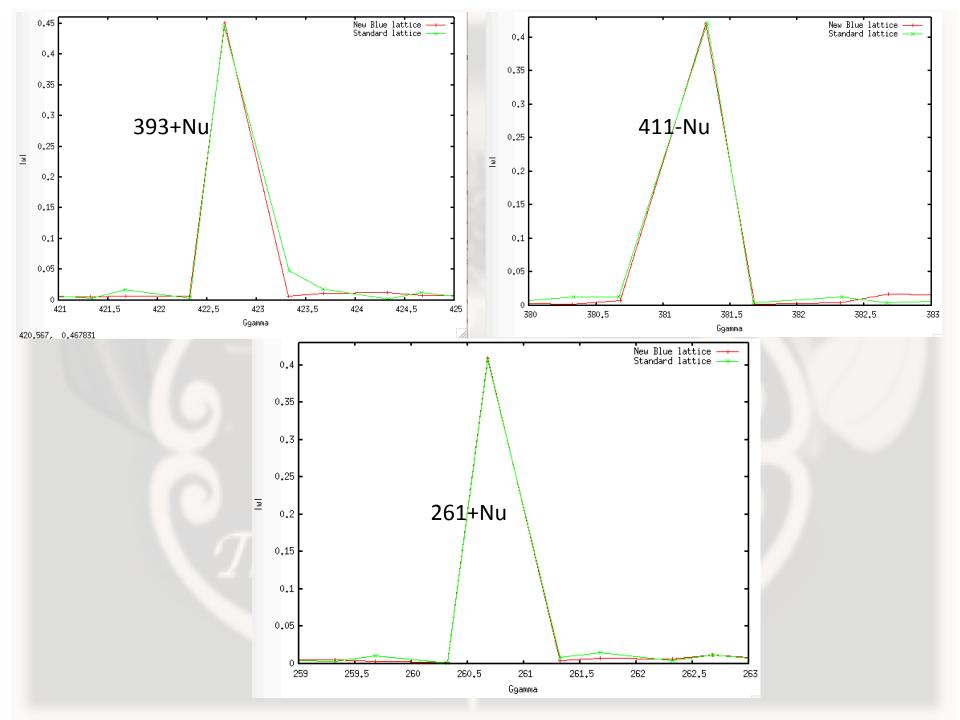
FIG. 1. Comparison of the Blue (top) and Yellow (bottom) elens intrinsic resonance strengths with standard RHIC lattice for $393 + \nu_y$

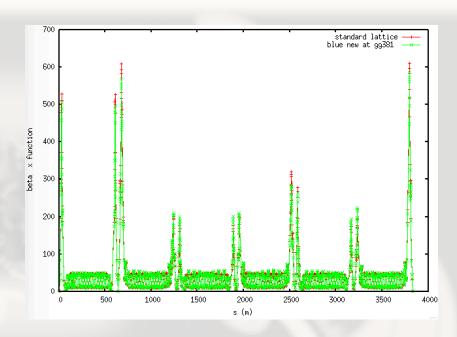
Challenges designing e-lens lattice

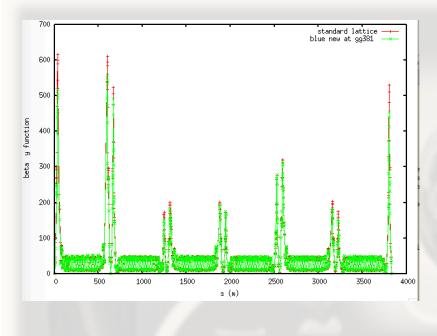
- For Blue lattice on the ramp, we have solutions which minimize the neighboring spin resonances using the standard lattice with standard integer tunes.
- The old e-lens lattices all used integer tunes higher or lower than the standard lattice.
 - We could not yet find a good solution for the neighboring resonances using the higher tunes in Blue (what was used at 100 GeV in FY15)
 - We did manage to modify the Blue standard lattice with standard tunes to achieve the appropriate phase advance
 - However this required larger beta functions in the arc between IP8 and IP10.
 We are currently testing this lattice for DA to see how it performs
 - The yellow standard lattice is already very close to the appropriate phase advance necessary for e-lens. So we have developed a solution which keeps the beta functions nearly unchanged. We also are in the process of testing this solution for DA performance.

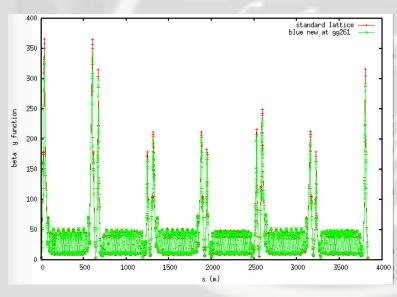
Tentative Solution

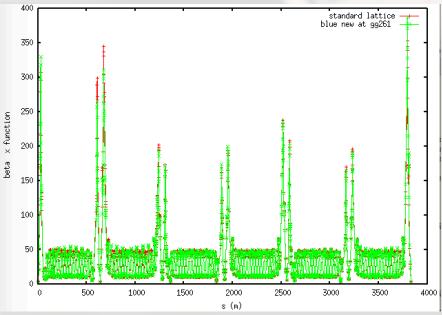
- We have both Blue and Yellow stored lattice which seem to meet our requirements and live at the original standard lattice tunes.
- We also have solutions for these tunes on the ramp which should minimize polarization losses.
- Since they are both in the same tune space we hope that we can ramp from one to the other configuration without too much trouble.

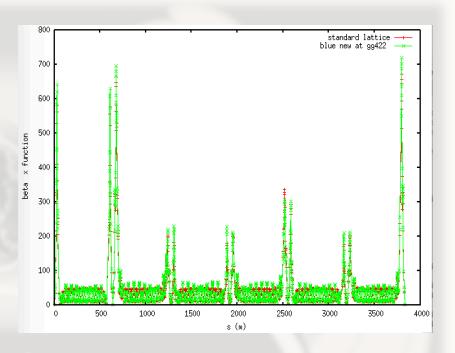


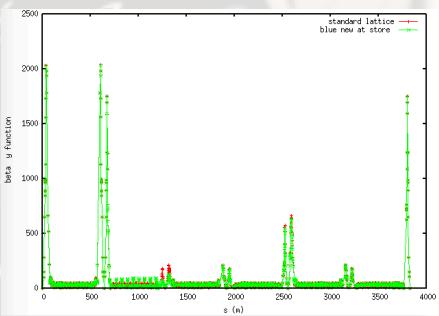


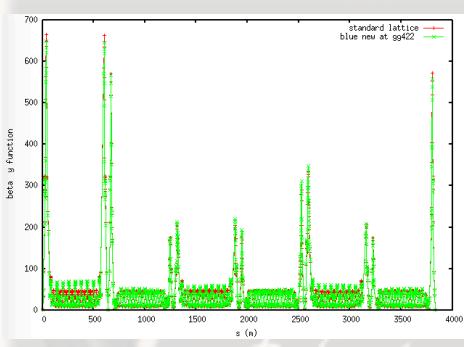


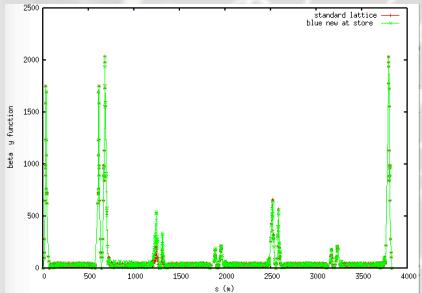






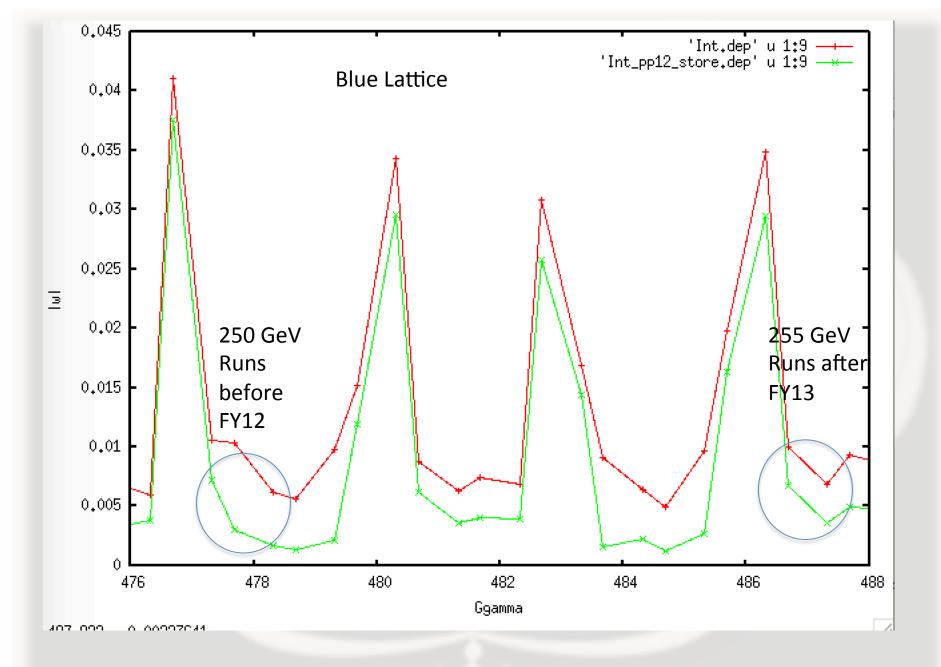




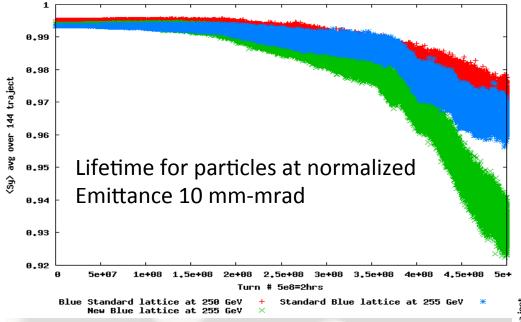


Polarization Lifetime issues

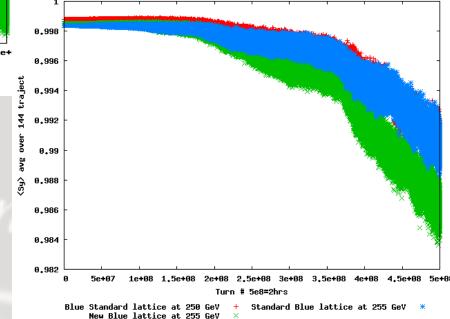
- Recent Simulation work has demonstrated the importance of the strength of the nearest spin resonance to lifetime.
- However for the Blue with e-lens phase advance at the standard lattice tunes, so far, I don't have solution which makes the intrinsic resonance the same or better at energies around 250-255 GeV
- Yellow the situation is better we are about the same.

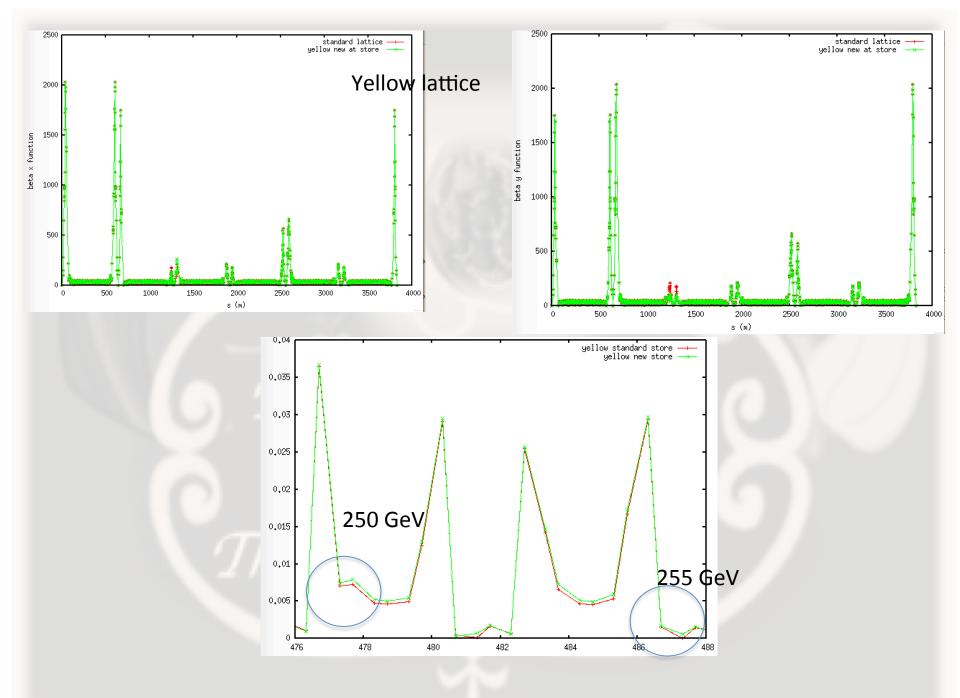


Resonance Strength and Pol. Lifetime



Lifetime for particles at normalized Emittance 2.5 mm-mrad



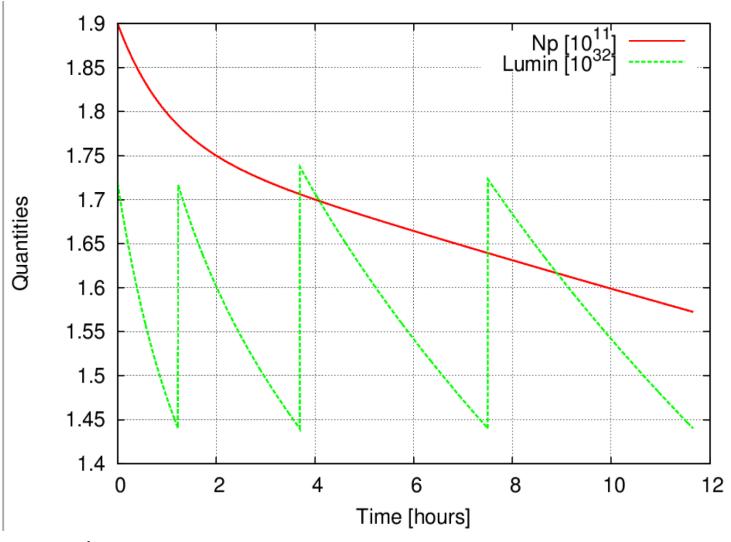


Luminosity Leveling

- STAR requires ZDC rates between 385-315kHz which translates in lumi of 1.76-1.44e32 cm^-2 s^-1
- Three approaches to achieve this:
 - Offset collisions → bad impact on polarization sampled since best beam in the bunch center
 - Dynamic Beta squeeze → Yun has estimated we can get away with only two squeezes over a 7 hour store. (from 1 to 0.8 to 0.6)
 - Design lattice with 'great' lifetime

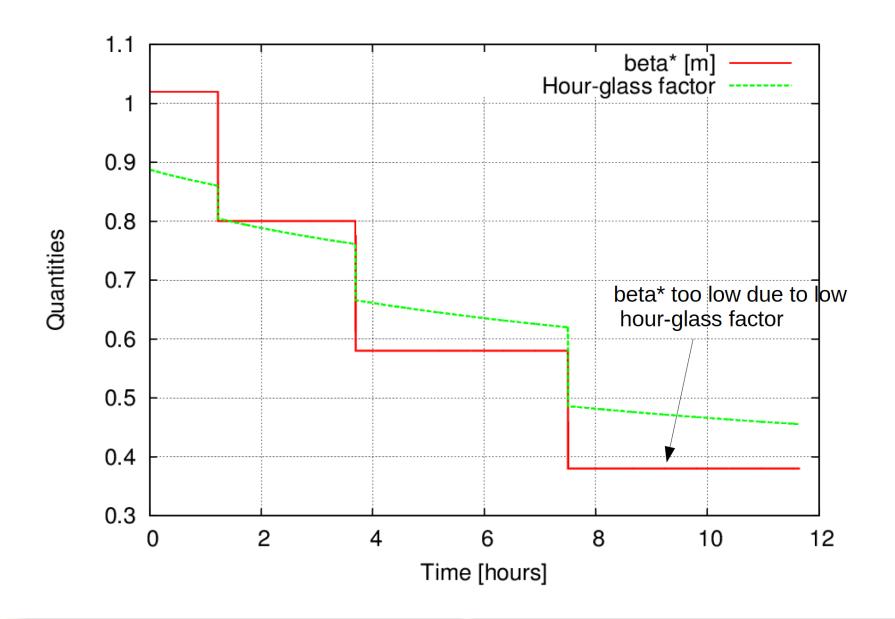
Courtesy Yun Luo

Case I: initial Np=1.9e11



Assuming Np= Np0 *(0.07 * exp(-t/1.0) + 0.93 * exp(-t/100.))

Courtesy Yun Luo



Conclusion

- We are closing in on a final stored lattice and designs for the three important stones, gg260,gg381 and gg422.
 - Next we need to check the DA and Pol. Lifetime results for the stored lattice
 - Design Ramp trajectory to move from injection through stones to stored solution.
- We have several strategies to handle luminosity leveling
- We are optimistic that if we can successfully suppress the neighboring resonances that we might be able to eliminate polarization losses on the ramp for even the large emittance bunches.
- Finally: I will be keeping a 'fun filled' diary of the run if you like to follow along in the future.

Thanks

Guillaume Robert-Demolaize, Yun Luo

• Also: Chuyu Liu, Wolfram Fischer, Vincent Schoefer, Elke Aschenauer.

Magic II The Hidden Craft